

Unconventional phase transitions in low-dimensional transition metal oxides involving t_{2g} electrons

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Abstract

We have performed x-ray scattering, magnetic susceptibility, and heat capacity measurements on TiOCl single crystals. Structurally TiOCl consists of buckled square lattice titanium-oxide layers separated by chlorine. Electronically, the titanium ions are in the d^1 configuration and have spin 1/2, similar to the undoped parent compounds of the superconducting cuprates. The magnetic exchange coupling is $J \approx 60$ meV. On cooling, the susceptibility begins to fall around 100 K, followed by an additional sharp drop at 65 K. Our x-ray measurements reveal a dimerization of the lattice along the b-direction at low temperatures, indicative of a spin-Peierls transition. There are differences, however, and the low temperature transition does not follow conventional spin-Peierls behavior. Implications for neutron scattering experiments will be discussed. If time permits, recent results on superconducting single crystals of $\text{Na}_{0.3}\text{CoO}_2 \cdot \text{H}_2\text{O}$ will also be discussed.